

SYNTAX ZX80[®]

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MICROACE TO DISCONTINUE KITS

MicroAce is phasing out its computer kits. According to Bill Clark of MicroAce, Sinclair didn't renew MicroAce's license. The company also scrapped plans for a kit using larger ROM. "We can't compete with the ZX81 in price," Clark said. Other projects continue, however. MicroAce plans upgrade kits for machines, and video boards are in production.

CAI PRINTER UPDATE

CAI Instruments will offer software components to make their Widget printer compatible with both 4K and 8K ROMs.

Since the ROMs have different character sets, CAI designed two different EPROMs (Erasable Programmable ROMs) to direct their printer. If you ordered a 4K-compatible printer and have bought an 8K ROM since then, you can exchange EPROMs for \$10, according to CAI's Bob Swann. He also said that you can order both EPROMs at the same time by adding \$15 to the Widget's price of \$99.95. Contact CAI Instruments, Inc., PO Box 446, Midland, MI 48640 or call 517/835-6145.

ZX80/ZX81 USERS CLUB

The ZX80/ZX81 Users Club in Surrey, England serves all users, beginner to expert. For an annual membership of £6 in the UK (£10 overseas), you get a newsletter, software, and technical assistance. Write to PO Box 159, Kingston Upon Thames, Surrey England KT2 5UQ.

FOR SYNTAX READERS ONLY

Sinclair now offers used ZX80s for only \$49.95. According to Nigel Searle of Sinclair, most of these machines were sold in England as kits and assembled incorrectly.

All items included in the package are used. You'll get a complete (but not necessarily working) ZX80 and an instruction manual. At least the major ICs will be socketed.

You will not get, however, an AC adapter, transfer switch, or video or cassette cables. They are available for an extra \$15. There is no warranty on used ZX80s.

If you need an extra computer for spare parts or just want to tinker with one, send your order marked "Special kit offer" with a check or money order to Sinclair Research Ltd., 50 Staniford St., Boston, MA 02114.

ZX80 POCKETBOOK

THE ZX80 POCKETBOOK is now available from SYNTAX for \$14.95 plus \$1.50 shipping & handling. The 110-page book reviews 4K BASIC and provides program listings for games. Appendices explain error and Z80 machine language codes. Send check or credit card number (Visa, MasterCard, Amex, Diner's) with expiration date to SYNTAX, RD 2 Box 457, Bolton Rd., Harvard, MA 01451 or call 617/456-3661.

EZUG's Eric Deeson asks those interested in subscribing to the EZUG newsletter (Jun. 81 p.1) to send \$2 postage for one issue, \$10 for six.

SYNTAX ERRORS

In LETTERS last month, we defined RND(J) in 4K as setting the random number generator to J. RND(J) actually gives a random number between 1 and J.

Mel Routt asks that line 115 of his Loan Amortization program (July 81) be changed to:
115 IF A\$="NO" THEN GO TO 10

Here are corrections to 30 PROGRAMS FOR THE SINCLAIR ZX80 by Melbourne House, courtesy of Image Computer Products, Inc.:

Noughts and Crosses, p.26
610 GO TO 790

Nim, p. 34
690 IF T(0) > 0 THEN GO TO 745
745 FOR R = 1 TO 3

Blackjack, p. 40
780 IF N(2) = 21 AND N(0) = 1
THEN LET W = 2

Bubble Sort, p.42
130 LET L = N + K - I

Maths Drill, p. 70
670 STOP

Life, p.77
450 NEXT I
460 FOR I = 9 TO 55

Prime Numbers, p.79
150 IF X / A(R) > A(R) THEN GO TO
180

Simultaneous Equations, p.82
610 IF NOT D / GCD = S THEN
PRINT "/" ; ABS (D / GCD) ;

Chomp, p.95
140 LET A(0) = 53
325 PRINT

Capitals of the World, p.73
(The second line numbered 430
should be 440, the line numbered

440 should be 450, and the line
numbered 450 should be 460.)

DATA FILE FORMAT

Here's a program for 2K MicroAces that allows you to create indexed files on tape. Changes for 1K RAM follow the listing.

In this listing, I put some data in place to give you an idea of how the program works. It takes a filename, a table of contents indexed to line numbers in the program, and text. To start your own file, delete lines 100-115 and

OUR POLICY ON CONTRIBUTED MATERIAL

SYNTAX ZX80 invites you to express opinions related to the ZX80 and the newsletter. We will print, as space allows, letters discussing items of general interest. Of course, we reserve the right to edit letters to a suitable length and to refuse publication of any material.

We welcome program listings for all levels of expertise. Programs can be for any fun or useful purpose. We will test run each one before publishing it, but we will not debug programs; please send only workable listings.

In return for your listing, we will pay you a token fee of \$2.00 per program we use. This payment gives us the nonexclusive right to use that program in any form, world-wide. This means you can still use it, sell it, or give it away, and so can we.

We will consider submissions of news and hardware or software reviews. Please keep articles short (350-400 words). Again, we reserve the right to edit accepted articles to a suitable length. We will pay 7 cents per 6 characters, including spaces and punctuation, for accepted articles.

When you send in programs for possible publication in SYNTAX, please include the following information:

- How to operate the program, including what to input if it does not contain prompts.
- Whether you can run the program over again and how.
- How to exit the program.
- The Syntactic Sum (using the Syntactic Sum program in the February, 1981, issue).
- Whether it fits in 1K or 2K RAM (or 16K when available).
- Whether it uses the 4K or 8K RAM.

We pay for this explanatory text at the same rate as for articles in addition to payment for the program itself.

If you want us to return your original program listing or article, please include a self-addressed, stamped envelope. Otherwise, we cannot return submitted material.

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500-515. Then SAVE on tape (make a master copy for other files).

LOAD a blank format tape and put your filename in the PRINT statement at line 100. Then add the table of contents (copying the format shown in the sample listing) in lines 100 through 299. Enclose information in PRINT statements between lines 500 and 4999. Separate blocks of text with GO TO 5000 statements. Type LIST (NL) so you can add the next line to your table of contents.

When you finish typing data, hit RUN (NL). Your table of contents will be displayed with a numeric prompt. Select the desired category and enter its number and NEWLINE. Data will be shown with a " " prompt. Keying (NL) returns you to your table of contents.

The routine at 9000 allows you to check how much unused RAM space you have before entering new data. After you get the program listing, enter RUN 9000 (NL). Hit any key to return to the listing.

To exit program, type STOP (NL) (NL). Then SAVE this finished program on tape. If you can't get all the information you want on any one program, LOAD a clean format tape. Title it and go from there.

Keep a paper log of your file tape to locate data easily.

John D. Andrews, San Jose, CA

```

10 PRINT " DATA FILE"
20 PRINT "      " (shift W)
30 PRINT
40 PRINT "IF PROMPT= QUOTES -
KEY NEWLINE"
50 PRINT
60 PRINT "DATA LISTING"
70 PRINT "-----"
-----" (32 dashes)
80 PRINT "      DATA
LINE NO."
90 PRINT "-----"
-----" (32 dashes)
100 PRINT "      AUTOMOTIVE"
110 PRINT "TIRES",,, "500"
115 PRINT "TIMING",,, "510"

```

```

300 INPUT A
301 CLS
302 GO TO A
500 PRINT " SIZE= H78-15. PRES
SURE= 30 PSI"
505 GO TO 5000
510 PRINT " 3 DEGREES BTDC"
515 GO TO 5000
4999 STOP
5000 INPUT A$
5001 IF A$="" THEN CLS
5002 GO TO 70
9000 CLS
9001 LET P=18432-PEEK(16400)-PEE
K(16401)*256
9002 PRINT P;" BYTES LEFT"
9003 LET T=2048-P
9004 PRINT "BYTES USED= ";T
9005 STOP
Syntactic Sum: -23289, 4K

```

MODIFICATIONS FOR 1K RAM

line 9001: change 18432 to 17408.
line 9003: LET T=1024-P.

Use GO SUB 5000 between blocks instead of GO TO 5000
new syntactic Sum: -23264, 4K

LOAN AMORTIZATION REVISITED

Those who have 8K ROM with only 1K RAM can modify Mel Routt's Loan Amortization program (July 81) to run in their machines. Delete lines 1-9, 105-535. In line 95, insert a space between PAYMENT and "=" . Add the following lines:

```

91 PRINT
105 PRINT "ITS A PLEASURE TO SE
RVE YOU. TO PROCESS ANOTHER L
OAN PRESS NEWLINE."
110 INPUT X$
115 IF X$="" THEN GOTO 10
120 STOP
500 LET X=(INT (100*(X+(.005)))
)/100
505 RETURN

```

(NOTE: The double quotation marks on line 115 are shifted P's. And we tried but couldn't change it to fit in 4K ROM. Any takers?--SB)
Syntactic Sum: 24757, 8K

HARDWARE REVIEW: LJH'S KEYBOARD

I tested LJH Enterprises' pre-wired keyboard. Their ad says "wired keyboard hooks up in minutes," but this project may take beginners 1-2 hours. (Of course, more experienced solderers will finish faster.)

The keyboard nicely improves typing on my ZX80. It is narrower (from A to NL) than other big keyboards (like typewriters) and requires a firm touch, but causes no problems with typing. It comes with all keys wired and a cable of wires to solder to ZX80 components. The package also includes 3 pages of directions and 3 pages of diagrams, plus rub-down transfer letters to relabel keys. The keyboard has no extra keys to confuse you as some surplus boards might (although the key for NEWLINE is labelled DELETE on my keyboard). Otherwise, all keys correspond to those on ZX80/ MicroAce keyboards.

Although the keyboard works perfectly and greatly increases my typing speed and accuracy, I wasn't so thrilled with it while I was soldering it. The directions may be clear to experienced people, but were not entirely clear to me. I expect that primarily non-hardware people would rather pay \$75 for the pre-wired keyboard than build their own or buy LJH's kit despite the cost savings, so the instructions to hook it up should be clear and exact. They don't warn you that you need some soldering skill to connect the wires. They don't tell you to disconnect your computer before starting, or how to take off the cover, or what to do if something doesn't work. (Beginners--see hints following for help with opening your computer and soldering wires.) On the other hand, Leonard Holmberg of LJH is very ready and available to offer advice and clarification over the phone. He even offered to connect my keyboard for me when I said I had a little

trouble. He has connected other people's as well.

If you can handle a soldering iron but do not care to construct an entire keyboard, LJH's pre-wired keyboard is wonderful. With some patience and the advice below, even beginners can connect it and enjoy that thrill of accomplishment.

Wired keyboard with plans, \$75.00 + \$5.00 mailing in US, LJH Enterprises, P.O. Box 6273, Orange, CA, 92667, 714/772-1595.

SOLDERING HINTS

Even if you're not a hardware person, you can connect external devices to your computer without fear. You only need a few hints to successfully solder your ZX80.

First, disconnect the power and video cables and remove the computer's cover. With a pin or paper clip, push down on the centers of the plastic rivets holding the case together until their cores pop out. Flip the computer over, squeeze each rivet together, and push it out. Don't lose these pieces! Turn the ZX80 back over and lift off its cover.

Strip about 1/8"-1/4" of insulation off the end of the wire with wire strippers or a penknife. If the wire you want to solder is stranded (made out of several tiny wires inside the insulation), twirl the wires between your fingers to roll them into 1 thick wire. Tin the wire before you solder it to help get a good heat transfer and solder joint. (Tinning means melting a little solder with the iron onto the wire before using it.)

If you're soldering onto a wire already on the board, bend the tinned exposed wire over your fingernail or around a small pliers into a hook. Hook the bent wire around the other wire on the board (not completely around--you might want to get it off some day).

Touch the iron to the joint to heat it and touch the solder to the

hot joint, allowing it to melt. If the wire is light and the hook won't stay where you put it, clip a wooden clothespin to the wire about an inch behind the exposed part. The heavy clothespin will keep tension on the hook and prevent it from slipping as you solder.

If your device doesn't work when you finish, you may have a cold solder joint. To fix this, reheat the joint until the solder melts. Pull the wire gently to make firm contact with the component, then let solder cool.

Replace the cover and squeeze rivets together to fit them through their holes. Push a center pin into each rivet to secure it.

IN AND OUT OF MACHINE LANGUAGE

You usually talk to your computer in BASIC, whose commands are the keywords on your keyboard. But when you use machine language (ML) programs, you have no keys to

press directly. So we need to tell the machine to RUN a ML program, and to tell it to STOP.

USR(X) and USR X, on the 4K and 8K ROM respectively, are BASIC commands you can type on your keyboard that tell the computer to RUN a ML program. X, called the argument of the command, is the address of the first ML command in the program. USR tells the ZX80 to go to the address X and execute ML until told to stop. Put your USR call at the end of a BASIC program POKEing ML commands (see Beginners' Loading ML Programs, this issue).

But once you transfer computer control to a ML program, it will never come back unless a RETURN statement in the ML program tells it to. This command sends the computer back to BASIC. In decimal ML programs, this command is 201 (C9 in hex). Check that this is the last command in any ML program you run, or you'll have to pull the plug to get your machine out of ML.

LAMO-LEM PRESENTS:

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4K ROM: DISPLAY ROUTINE

DISPLAY begins the 4K ROM's input/output module at 013Ch, or 316d. We initialized system variables D8FILE (D-FILE), FRAMES, RESULT, and CH8ADD (CH-ADD) using EQUate statements at the beginning of our assembly.

This routine controls sync,

display, and keyboard scanning. You can use it either by branching from a USR routine into ROM or by incorporating the module into your own machine language (ML) program.

DISPLAY jumps back to BASIC after execution. If you decide to call it from the ROM, remember that you'll have to jump back to ML with another USR call.

ANNOTATED 4K ROM LISTING — DISPLAY

013C	00100	ORG	013CH	
4000	00110	Y EQU	4000H	
400C	00115	D8FILE EQU	400CH	
401E	00120	FRAMES EQU	401EH	
4022	00130	RESULT EQU	4022H	
4026	00140	CH8ADD EQU	4026H	
013C	CDAD01	00150 LD1 CALL	LD9	;SPACE BETWEEN LAST LINE OF
		00160		;CHARS AND FRAME SYNC
		01010		;DISP -- ENTER HERE FROM BASIC TO DISPLAY RESULTS
013F	0608	01020 LD	B,8	
0141	10FE	01030 DJNZ	\$;WASTE 99 T-STATES
0143	2A1E40	01040 LD	HL,(FRAMES)	
0146	23	01050 INC	HL	
0147	221E40	01060 LD	(FRAMES),HL	
014A	21FFFF	01070 LD	HL,-1	
014D	06FE	01080 LD	B,0FEH	
014F	48	01090 LD	C,B	
0150	ED78	01100 IN	A,(C)	;START FRAME SYNC
0152	F601	01110 OR	1	
0154	F6E0	01120 LK3 OR	0E0H	
0156	57	01130 LD	D,A	;ZERO BIT FOR EACH KEY THAT
0157	2F	01140 CPL		;IS PRESSED
0158	FE01	01150 CP	1	
015A	9F	01160 SBC	A,A	;0 IF ANY KEY PRESSED, -1 IF NONE
015B	B0	01170 OR	B	
015C	A5	01180 AND	L	;CLEAR THE BIT FOR THIS ROW IN
015D	6F	01190 LD	L,A	;L IF ANY KEY DOWN
015E	7C	01200 LD	A,H	
015F	A2	01210 AND	D	
0160	67	01220 LD	H,A	
0161	CB00	01230 RLC	B	
0163	ED78	01240 IN	A,(C)	
0165	38ED	01250 JR	C,LK3	
0167	1F	01260 RRA		
0168	CB14	01270 RL	H	
016A	17	01280 RLA		
016B	17	01290 RLA		
016C	17	01300 RLA		
016D	9F	01310 SBC	A,A	
016E	E618	01320 AND	24	;0 IF US, 24 IF UK
0170	C620	01330 ADD	A,32	

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```

0172 322340 01340          LD      (RESULT+1),A      ;32 IF US, 56 IF UK
01350 ;NOW L HAS 0 FOR EACH ROW IN WHICH A KEY OTHER THAN SHIFT
01360 ;IS PRESSED, H SIMILARLY FOR COLUMNS IN D1 TO D5, D6D7
01370 ;ONES, D0=0 IF SHIFT PRESSED, ELSE
01380 ;717 T-STATES SINCE START OF FRAME SYNC, 545 BEFORE END
0175 ED4B2640 01390          LD      BC,(CH8ADD)      ;PICK UP LAST TIME'S KEY
01400 ;HITS, OR A VALUE WITH D1514=01 IF
0179 222640 01410          LD      (CH8ADD),HL      ;FIRST TIME ROUND
017C 78      01420          LD      A,B
017D C602    01430          ADD     A,2
01440 ;NOW EITHER CARRY IS CLEAR AND BC INDICATES A KEY WAS
01450 ;PRESSED OR CARRY IS CLEAR AND BC FFFFH OR FEFFH.
01460 ;NB NEITHER 0000H NOR FF00H IS A POSSIBLE VALUE FOR HL
01470 ;SINCE D6D7 OF H ARE SET & IF ALL OF D1 TO D5 OF H ARE
01480 ;SET THEN NO KEY IS PRESSED AND L = -1
017F ED42    01490          SBC     HL,BC          ;HL :=0 IF HL=BC AND
0181 EB      01500          EX      DE,HL      ;C NOT FFH
0182 212240 01510          LD      HL,RESULT
0185 7E      01520          LD      A,(HL)
0186 B2      01530          OR      D
0187 B3      01540          OR      E
0188 C8      01550          RET     Z          ;IF (X8PTR)=BC, A KEY IS PRESSED,
0189 78      01560          LD      A,B          ;AND COUNT=0. EXIT WITH ADE=0
018A FEFE    01570          CP      254
018C 9F      01580          SBC     A,A          ;A:=0 IF NO KEY LAST TIME,-1 ELSE
018D 061F    01590          LD      B,31
018F B6      01600          OR      (HL)       ;A:= (HL) IF NO KEY LAST TIME,
0190 A0      01610          AND     B          ; -1 ELSE *
0191 1F      01620          RRA          ;NB SHIFTS IN A ZERO
0192 77      01630          LD      (HL),A
0193 05      01640          DEC     B
0194 10FE    01650          DJNZ   $          ;FRAME SYNC ENDS AT NEXT M1
0196 D3FF    01660          OUT     (OFFH),A
0198 3EEC    01670          LD      A,-20
019A 0619    01680          LD      B,25
019C 2A0C40 01690          LD      HL,(D8FILE)
019F CBFC    01700          SET     7,H
01A1 CDAD01 01710          CALL   LD9        ;DISPLAY SPACE ABOVE PICTURE AND
01A4 3EF3    01720          LD      A,-13     ;24 LINES OF TEXT
01A6 04      01730          INC     B
01A7 2B      01740          DEC     HL
01A8 FD3523 01750          DEC     (IY+RESULT+1-Y) ;ONE LESS LINE BELOW
01AB 188F    01760          JR      LD1        ;PICTURE THAN ABOVE
01770 ; SRTN TO DO THE DISPLAYING
01AD FD4E23 01780 LD9      LD      C,(IY+RESULT+1-Y) ; # PICTURE LINES
01B0 ED4F    01790          LD      R,A        ;IN FIRST LINE OF TEXT
01B2 3EDD    01800          LD      A,-35     ;VALUE FOR R IN SUBSEQUENT LINES
01B4 FB      01810          EI
01B5 E9      01820          JP      (HL)
01830 ;WILL RETURN TO CALLER AT END OF PICTURE

```

For BASIC and machine code display
games and routines, write ZETA

Software, Post Office Box 3522,
Greenville, SC 29608.

DEAR EDITOR:

One of the reasons for purchasing my ZX80 was an article stating that Sinclair would produce silicon chips for other high-level languages such as COBOL, FORTRAN, and ALGOL. Does Sinclair plan to do this, or was someone just speculating?

Bill Peckenpaugh, Gualala, CA

According to Nigel Searle of Sinclair, there will be no Sinclair chips for higher-level languages. We would love to know where you saw the article, though.--SB

I notice that you use the term "Syntactic Sum" at the end of your published programs--what does it mean, and what usefulness is it to programmers?

Daniel Deadmore, Cleveland, OH

Syntactic Sum (Feb. 81, p.7) enables you to check your input with SYNTAX listings. In 4K machines, the technique counts up all character codes in ZX80 working space. 8K Syntactic Sum counts number of bytes used as well as character codes. Type your program in, run Syntactic Sum, and compare what you got to what we list underneath the program. If the two differ, you've made a typo.--SB

I have a stereo cassette player. When recording, I plug the ZX80 output into the left channel and a microphone into the right channel. I first give the program name on the cassette and then SAVE the program on the left channel.

Then, when LOADING from cassette, I leave the right speaker connected to my stereo and connect the ZX80 input to the other speaker output. I hear myself announcing the program, and the ZX80 alone

hears the "gosh-awful noise", as my wife used to call it. When cassettes are recorded this way, you can still use them on a regular portable cassette player.

Edward A. Goettman, Rochester, PA

I just recently constructed MicroAce's 2K kit and found two annoying bugs. The first problem, ineffective video drive to 74LS00 gate, I fixed by changing C12 (47pF disc ceramic capacitor) to 100pF.

The other problem, difficulty in typing some characters in from the keyboard, I cured by pulling up all keyboard columns with a 1/4-watt 10k Ω resistor to +5V. I mounted resistors on the MicroAce board's foil side, one end connected to the anode of the diode, the other to a +5V trace running adjacent to the diodes.

No problems now. Thanks to Mr. Bill Clark and technicians at MicroAce for their help.

William Kresl, Elkhorn, WI

If one makes a hardware modification on a ZX80, how does that affect the warranty?

John M. Morrison, Moorestown, NJ

Hardware changes void the 90-day warranty, says Sinclair.--SB

Since the computer uses bit locale within 8 bytes to generate characters, is there some way to construct and display other unique characters or modify the print sequence so each pixel is not 1/4 of a character square but rather 1/64 of a square?

Tom Roseland, Riverside, CA

Yes, but not simply. The bits are stored in ROM, and we have not yet

found a way to divert the display routine to look in RAM for data.

Using 4X or 8X high characters, you can create any shape you wish by changing the source of data from ROM to RAM. Just create bit patterns in 8 consecutive locations and change the PEEK address to read your location instead of ROM. See SON OF BIG CHARACTERS (Feb.81).--KO

Upon testing my 8K ROM, I discovered the same errors David Shulman described (July 81, p.8). I have sent for a replacement. My concern: will programs taped on the original 8K ROM work for the replacement ROM?

Stephen Levy, Bowie, MD

Yes. According to Sinclair's Nigel Searle, the changes won't affect what the computer understands, just what it does.--SB

*Dann Weldkamp, 321 S. 5th #216, Ames, IA 50010 would like to hear from users in his area. If you would like to contact local ZX80/MicroAce users, send us your name and address. We'll publish them when space permits.

SOFTWARE REVIEW

ZX80 DOUBLE BREAKOUT

Price: \$14.95+\$1.50 SH
RAM reqd: 1K
ROM reqd: 4K
Type of program: Game
Printed listing? No
Program listable? No
Screen prompts? Few
Easy to load? Yes
Challenge: Flexible
Display: Excellent

From: Softsync, Inc., P.O. Box 480,
Murray Hill Station, New York, NY
01058.

Creators of Double Breakout somehow crammed a wonderfully challenging, flicker-free game into 1K RAM. Problems with their first game, Super ZX80 Invasion (May 81, p.7), have largely been surmounted, although memory still limits computer/player interaction.

Softsync's package includes a cassette tape, one page of loading instructions, and one page of playing instructions, generally well put-together. The cassette contains two unlistable copies of Double Breakout, and starting instructions are printed on top.

As in Breakout, the object is to demolish a wall. In this version, two walls composed of different display elements provide you with something to destroy in nine rounds. By means of shifted 5 and 8 keys, you move your bat up and down the screen to deflect the ball before it goes out of bounds.

LOADing, a big problem when trying to play ZX80 Invasion, was no trouble in Double Breakout. I succeeded the first time, getting 100 REM on my screen.

After LOADing, I typed GO TO 1, just as both the cassette and instructions told me. I then chose from seven levels of difficulty, ranging from very fast (1) to very slow (7). Although I tried my best to get the program to crash, the computer ignored input other than that necessary to move the bat up and down on the screen.

Some aspects of play are inconvenient, however. You cannot end the game or change its level of difficulty without turning off the ZX80 and reLOADing the program. The creators sacrificed a decent running score to save memory -- only a small number in the upper left corner of the screen reminded me how many rounds I had left.

Otherwise, the display represents an incredible stretching of ZX80 capabilities. Double Breakout is sophisticated enough to satisfy even hard-core video junkies.

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IMPROVING DISPLAY

One problem with creating graphic displays on the ZX80 is users' inability to interact with display. This program allows you to manipulate a cursor on 14 screen lines and to insert characters where desired.

The program operates in two modes, each identified by the type of cursor displayed. The asterisk cursor indicates direction mode and will accept the following commands:

R= cursor right U= cursor up
L= cursor left D= cursor down
I= to insert mode S= stop program
(NL)= repeat last instruction

A question mark replaces the asterisk as cursor to indicate that the program has entered insert mode. During insert mode, the cursor continues to move in the last direction entered in direction

mode. The command ND (for new direction) shifts control from insert back to direction mode. (NL) repeats insertion of the last character chosen and moves the cursor to the next position. Any other input is inserted as a character at the cursor position.

Insert mode input can be character codes (see p.75 of your ZX80 manual) or single-character keyboard symbols, except those identified as not available (p. 117 of your manual -- these cause interesting crashes).

You can move the asterisk cursor beyond the side edges of the display to alter characters in the end horizontal positions (columns 1 and 32). If you move past the top or bottom rows, however, you will disrupt the display, but the computer will still accept the R command. When the ZX80 recovers, you can use the top row.

Once you've entered the program, type RUN (NL). A screen full of colons will appear; the cursor will not be visible until after you enter a direction command (R,L,U, or D). If you want to modify the initial background, change the 14 in line 150 to the new symbol's character code.

This program runs in 1K RAM; if you have more memory, you can expand display space by increasing the second value of the loop on line 100. Some alterations of the program may affect the initial POKE of the cursor, so check line 140.

Will Hiatt, Yakima, WA

```
100 FOR X=1 TO 448
110 PRINT ":";
120 NEXT X
130 LET N=20
140 LET Q=17083
150 LET C1=14
160 INPUT A$
170 LET X=CODE(A$)
180 LET A$=TL$(A$)
190 LET Y=CODE(A$)
200 LET Z=CODE(TL$(A$))
```

```

210 LET F=0
220 IF N=20 THEN LET C=C1
230 IF X=1 THEN GO TO 330
240 IF N=20 THEN GO TO 300
250 IF Y=41 THEN GO TO 420
260 LET C=X*100+Y*10+Z-3108
270 IF NOT Y=1 THEN LET F=2
280 IF Y=1 THEN LET C=X
290 GO TO 330
300 IF X=46 THEN GO TO 450
310 IF X=56 THEN STOP
320 LET D=X
330 IF D=55 THEN LET P=Q+1
340 IF D=49 THEN LET P=Q-1
350 IF D=58 THEN LET P=Q-33
360 IF D=41 THEN LET P=Q+33
370 POKE Q+F,C
380 LET C1=PEEK(P+F)
390 POKE P+F,N
400 LET Q=P
410 GO TO 160
420 LET N=20
430 LET F=1
440 GO TO 390
450 LET N=15
460 GO TO 390

```

Syntactic Sum: -20876, 4K

(NOTE: This program won't run with Syntactic Sum LOAded.--SB)

BEGINNERS' LOADING ML PROGRAMS

This month we'll learn how to put machine language (ML) programs into your computer. You may not understand ML programs you use, but following these directions, you can load any ML program. We have 2 ways to do this, with decimal or hexadecimal (hex) numbers.

In COMPUTER NUMBER SYSTEMS, Mar.81, we learned to convert decimal numbers, our usual 1-10 counting system, into hex (or base 16) numbers, and vice versa. Far from being just a math exercise, this skill will now come in handy.

In June's SYNTAX, we saw that BASIC command POKE A,B puts code B into address A. POKE uses decimal numbers. You can POKE decimal ML code, just as we POKEd character code. Try this simple ML program.

Here's the decimal listing for a 4K ML program to add 45 and 15. (It's easier, of course, to write a BASIC program to do this, but we need a simple example.)

62 45 46 15 141 111 38 0 201
LOAD the PLACING USR CALLS IN 4K, 8K program (Jun.81 p.8) for 4K; use 1 for K. Our ML program has 9 commands, so use 9 for N, the number of bytes to reserve. Now you have RAM space that BASIC can't touch (otherwise, the computer could crash).

USR CALLS gives our first available RAM address as 16382-N+(1024*K). In this case, N=9 and K=1, so our first address is 17399. Simply POKE the decimal numbers one at a time into sequential RAM addresses, starting at 17399:

```

10 POKE 17399,62
20 POKE 17400,45
30 POKE 17401,46
40 POKE 17402,15
50 POKE 17403,141
60 POKE 17404,111
70 POKE 17405,38
80 POKE 17406,0
90 POKE 17407,201
100 PRINT USR(17399)

```

RUN
Don't worry right now what the codes stand for. Lines 20 and 40 enter the numbers to add; change these to add other numbers (whose sum doesn't exceed 255). This way, you can enter ML programs, whether or not you know how they work.

It's pretty tedious typing all those POKE statements; let's program the computer to do some of the work for us using a FOR-NEXT loop (see FOR-NEXT Loops, Nov.80):

```

10 FOR I=0 TO 8
20 INPUT X
30 POKE 17399+I,X
40 NEXT I
50 PRINT USR(17399)

```

RUN
You will get 9 input prompts. Type each decimal number, hitting NL after each. When you've entered

the last one, the answer to 45+15 will appear on the screen.

We can add BASIC frills to the program by adding and changing the following lines:

```
5 PRINT "ENTER DECIMAL NUMBER  
S ONE AT A TIME. HIT NL AFTER  
EACH."
```

```
50 PRINT "45+15=";USR(17399)
```

We can also enter the ML program in hex. Convert each decimal number into hex, using Bill Herron's decimal-to-hex conversion programs (Mar.81) or a hex calculator (or paper and pencil). Here's our hex listing:

```
3E 2D 2E 0F 8D 6F 26 00 C9
```

Each hex number corresponds in order to a decimal number.

To enter hex code directly, use a BASIC program like Matthew Johnson's Hex Monitor program (May 81). Again, reserve the 9 bytes our program takes up. Type one 2-digit hex number in response to each prompt from that program (each number must have 2 digits; that's why 0 is written as 00). Just hit (NL) after the "STORAGE LOCATIONS" prompt. This program automatically provides the USR call (line 50 in our BASIC program above).

The 4K Hex Monitor won't work with an 8K ROM. You can POKE the decimal listing in 8K, but use these decimal numbers instead:

```
62 45 46 15 141 79 6 0 201
```

(Include line 50's USR call at the end.) Two commands change because of the differences between the 4K and 8K ROM's USR command.

The POKE method may be easier for beginners. If you have an assembly with no decimal listing, just change the hex numbers to decimal and POKE them into addresses you reserved using PLACING USR CALLS. In SYNTAX assembly listings, hex code is in the second column of numbers. Remember that hex numbers are always expressed in 2 digits, even when they only need single digits (type 9 as 09, for example). So convert the hex numbers 2 digits at a time. If you

see a line like 3E40, read it as 2 hex numbers, 3E and 40.

STAR COUNT

Your assignment: assistant Navigation Officer on the starship Stellar Voyager, now en route to distant galaxies. As a backup to the ship's computer, you have been trained to make a rapid visual survey of the star patterns projected on the ship's view-screen. After each complete scan of the starfield, you must make an estimate of the total number of stars visible on the view screen.

Naturally, the ship's computer has already made a meticulous star-by-star count, but your visual estimate is expected to tally within 85% of the total reported by computer sensors. Less than a 70% score may mean that either you or the sensors need replacing.

LOAD program and use RUN (NL) to begin your first duty watch. When a prompt appears, use NL to begin the star scan. ZX80 will show a schematic view of star patterns ahead of the ship, stopping to request your estimate of the number of stars visible to the naked eye. Enter the number of your star count estimate and NL. ZX80 will report the true star count and your accuracy in percent on this scan. NL again for a new scan; press any key and NL to exit. On subsequent scans (up to 5), ZX80 also reports your running accuracy. If you can get into the 90% bracket, you're on your way to a brilliant career as interstellar navigator.

Otis Imboden, Washington, DC

```
10 PRINT "STAR COUNT"  
20 CLEAR  
30 LET R=0  
40 LET W=0  
45 FOR P=1 TO 5  
50 INPUT B$  
55 IF B$>" THEN GO TO 300
```

* THE ZX80 POCKET BOOK *

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```
60 CLS
70 LET S=0
80 FOR I=1 TO 429
100 GO TO 128+RND(16)*2
145 PRINT CHR$(128);
146 NEXT I
148 PRINT CHR$(142);
149 LET S=S+2
159 NEXT I
160 PRINT CHR$(155);
161 LET S=S+1
167 NEXT I
170 PRINT
179 PRINT "YOUR ESTIMATE..?";
180 INPUT A
185 PRINT A
190 PRINT CLS
200 PRINT ", " TRUE STAR COUNT= "
;S
210 IF A=S THEN GO TO 250
220 LET R=100-(100*(ABS(S-A))/S
)
222 PRINT "ACCURACY= ";R;" PERC
ENT"
223 IF P=1 THEN LET W=R
224 IF P>1 THEN LET W=(W+R)/2
225 IF P>1 THEN PRINT "RATE= ";
W;" SCANS= ";P
227 IF P=5 THEN GO TO 10
230 PRINT "NL FOR NEXT SCAN"
240 NEXT P
245 GO TO 300
250 PRINT " **** EUREKA...100 P
ERCENT ****"
300 STOP
Syntactic Sum: -20490, 4K
```

INPUT PORT

Our previous I/O hardware article described an output device addressed like memory. This month, we'll capture data through a port, placing it into a CPU register.

Your ZX80 or MicroAce uses a Z80 CPU chip that can address 256 ports, one-byte locations through which you can transfer data in or out of the ZX80. You simply need a tri-state gate and an address decoder. When the appropriate address appears, the decoder signals the gate to connect external data with D0'-D7' lines of the Z80 bus via the 46-pin connector at the rear of your ZX80.

Port and memory addresses differ, but the same number can refer to a memory location or a port. Your machine uses control lines MREQ and TORQ to tell one from another.

While the CPU requires 16 bits to access memory locations, Z80 chips use only 8 bits to address ports. Just AND the desired combination of A0-A7 with TORQ and RD. When this combination comes up on the bus, the external buffer connects the outside data to D0'-D7'. Signals on the bus don't conflict because input instructions that send TORQ tell the CPU to read

the bus rather than to control it. After the allotted time, IORQ disappears, and the external device loses its connection with the bus.

You use a simple machine language program, called from BASIC with a USR statement, to read the port and bring data into your program from other devices.

```

4K ADDRESS      HEX      OPCODE
43FAh          DB7F      IN A, (127)
43FC           2600      LD H, 0
43FE           6F        LD L, A
43FF           C9        RETURN
DECIMAL: 219 127 38 0 111 201
(POKE origin at 17402)

```

```

8K ADDRESS      HEX      OPCODE
43FAh          DB7F      IN A, (127)
43FC           0600      LD B, 0
43FE           4F        LD C, A
43FF           C9        RETURN
DECIMAL: 219 127 6 0 79 201
(POKE origin at 17402)

```

Before loading the USR routine, you must reserve RAM space. For 4K machines, see PLACING USR CALLS (Jun. 81,p.8); if you have an 8K machine, you can move RAMTOP down:

```

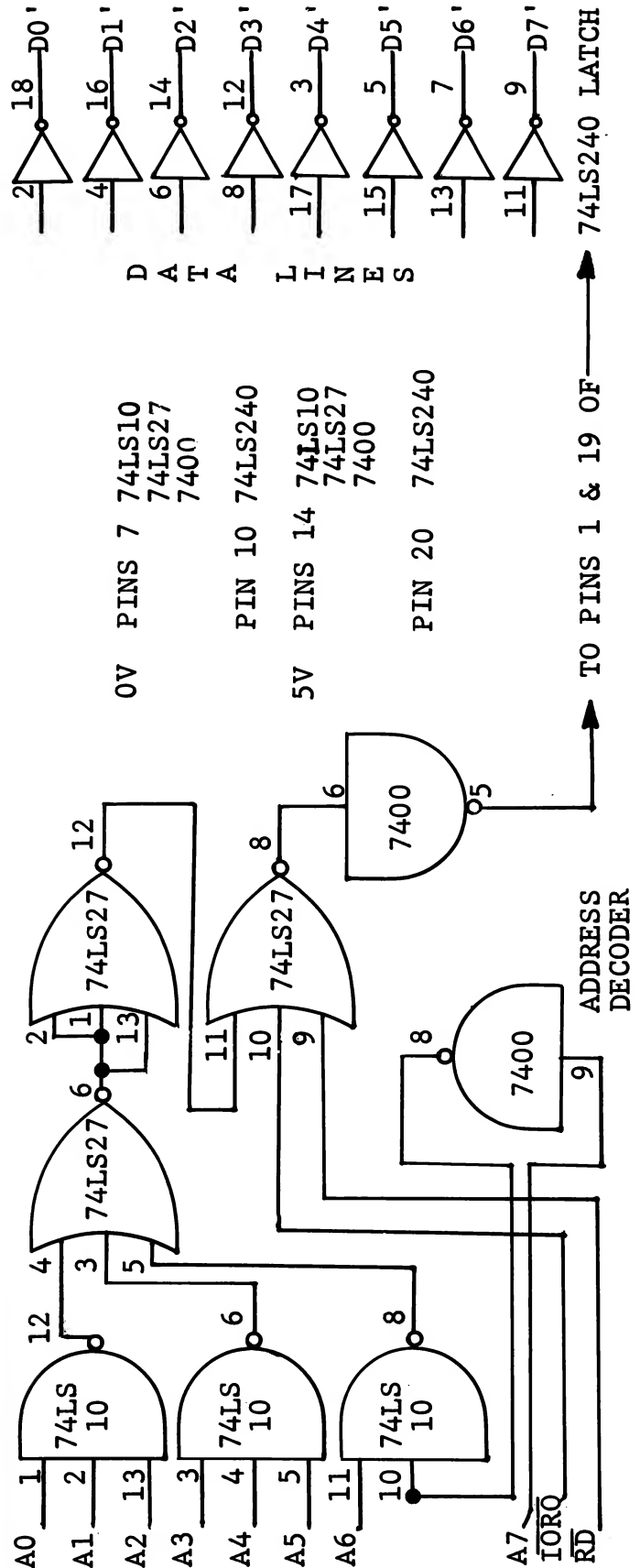
POKE 16388, 250
POKE 16389, 67
NEW (NL)

```

You can also assign data to an array in a FOR-NEXT loop. This way you can both read and store data simultaneously.

Because the ROM uses some ports for display and tape operations, not all are available to us. We used port number 127, but you might want to explore other odd-numbered ports.

You can use bits of the port one at a time, or the entire byte can represent a character. Thus, the 8 bits could read 8 switches on doors throughout your building or two BCD digits from a digital voltmeter. In fact, you can pack information into the byte any way you want--unscramble it with a program once it's in the machine.



ML SCROLL ROUTINE

In 1K ZX80s, large programs easily overfill the 24 available screen lines. This machine language routine deletes the top line from the screen so you can add lines to the bottom.

To use with 4K ROM, first LOAD Placing USR Calls (Jun.81) to reserve RAM space at the top of memory (this program uses 42 bytes; your first address is 17366). POKE in the Scroll routine, using the decimal listing below, then LOAD or type in a BASIC program.

Insert a USR call before each PRINT line in your BASIC program. A simple line like LET X=USR(17366) calls the ML routine but doesn't

affect what the computer prints (don't use X or any variable you choose elsewhere in your program).

After you fill the screen, the Scroll routine deletes 1 line from the top of the display for each line the program PRINTs at the bottom. This listing will scroll whenever the new line would be printed on screen line 20 or below. To change how many lines the routine PRINTs before scrolling, adjust the fifth number of the decimal listing. The number of lines printed will be 25-(the fifth decimal number). If you call this routine when the screen is empty, the fifth number must be <24.

Ken Berggren, Louisville, KY

4K SCROLL ROUTINE

43D6	00100	ORG	43D6H	
400A	00110	DFILE EQU	400AH	
400E	00120	DFEA EQU	400EH	
4025	00130	BOTLIN EQU	4025H	
0014	00140	SCROLL EQU	14H	
43D6	3A2540	00150	START	LD A,(BOTLIN) ;THE BOTTOM LINE
43D9	FE14	00160		CP SCROLL ;IF BOTLIN>SCROLL
43DB	F0	00170		RET P ;THEN RETURN TO BASIC
43DC	3C	00180		INC A ;ELSE ADD ONE
43DD	322540	00190		LD (BOTLIN),A ;TO BOTLIN
43E0	2A0A40	00200		LD HL,(DFILE) ;WHERE TO START
43E3	7E	00210		LD A,(HL) ;(NL) IN A
43E4	54	00220		LD D,H ;PUT HL IN DE
43E5	5D	00230		LD E,L
43E6	23	00240		INC HL ;FIRST CHAR IN FILE
43E7	EDB1	00250		CPIR ;FIND NEXT (NL)
43E9	ED4B0E40	00260		LD BC,(DFEA) ;WHERE TO END
43ED	1801	00270		JR SKIPHL ;DO NOT INC HL
43EF	23	00280	MOVBYT	INC HL
43F0	13	00290	SKIPHL	INC DE
43F1	7E	00300		LD A,(HL) ;MOVE (HL) TO (DE)
43F2	12	00310		LD (DE),A
43F3	78	00320		LD A,B ;COMPARE HL TO BC
43F4	94	00330		SUB H
43F5	20F8	00340		JR NZ,MOVBYT ;IF B<>H
43F7	79	00350		LD A,C
43F8	95	00360		SUB L
43F9	20F4	00370		JR NZ,MOVBYT ;IF C<>L
43FB	ED530E40	00380		LD (DFEA),DE ;REPLACE DFEA
43FF	C9	00390		RET ;RETURN TO BASIC

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ZX80 PORTS USED IN 8K ROM
IN: 221, 232, 254
OUT: 253, 255
BOTH IN AND OUT: 251 and 254

In 8K, use A\$(2 TO)(shift 4) to replace TL\$(A\$). This saves 3 bytes, says John Sampson of NY.

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